GAS IN INDUSTRY

MARCH 1960

Vol. 3 No. 22

FEATURES

SPECIAL REVIEW OF THE EXHIBITION NOW IN PROGRESS AT THE HORTICULTURAL HALL, LONDON, SHOWING NEW ASPECTS OF GAS AT WORK IN INDUSTRY

CREMATION—A RESUME OF PROGRESS TO DATE

By A. Higgs

JEAVONS PATENT GAS/AIR CUT-OFF VALVE

Published by

WALTER KING LTD
11, BOLT COURT FLEET STREET
LONDON, E.C.4.

Telephone: FLEet Street 2236-7
Telegrams: Gasking, Fleet, London

Editorial

Gas in modern industry

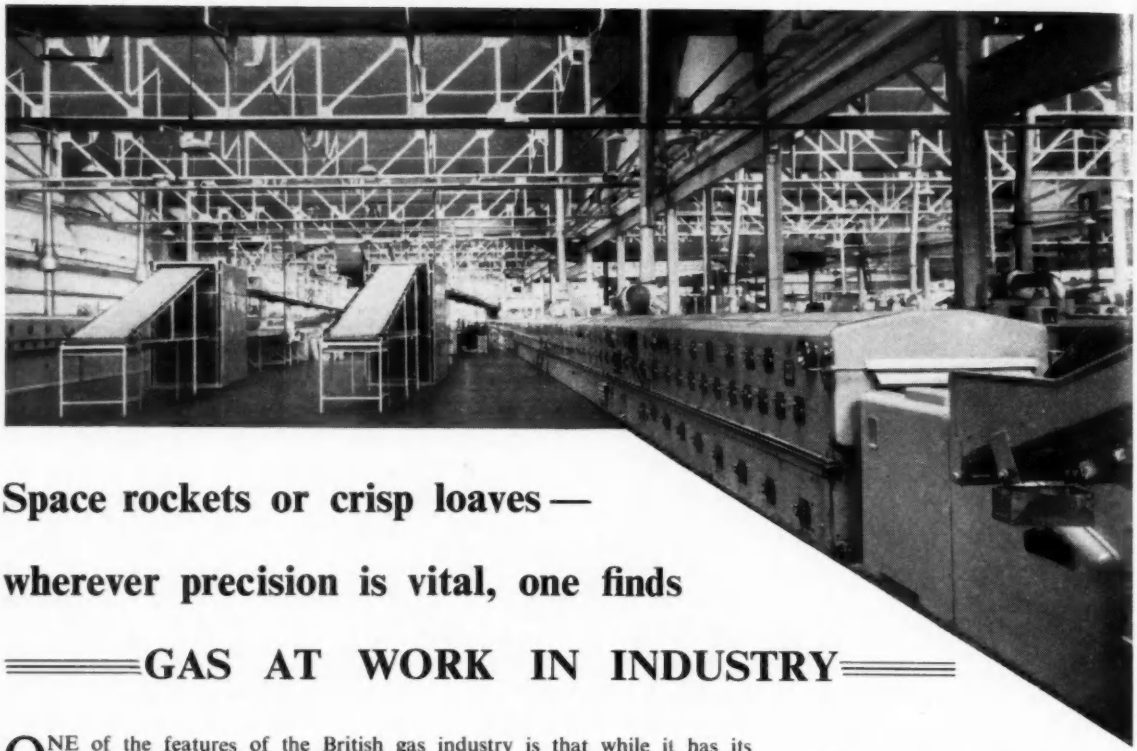
YESTERDAY there opened at the Royal Horticultural Hall, London, an exhibition which is in many ways unique. Gas at Work in Industry, as the exhibition is called, is an attempt on the part of four gas boards to show that there is hardly a facet of modern industry which does not to some degree owe its successful operation to gas—a fuel regarded by some people as more applicable to yesterday than today and tomorrow.

Sponsored by the Eastern, North Thames, South Eastern and Southern Gas Boards, the exhibition shows that in atomic energy, radar, electronics, aircraft, space travel and the modernisation programmes for roads and railways gas is playing its part. This is due to two factors: The extraordinary versatility of gas as a fuel, which permits its fine control and reliability to be adapted to suit the needs of a thousand processes; and the skill and experience of the gas board engineers whose willingness to work with manufacturers and technicians has ensured the acceptance of gas in many industries to which it at first seemed unsuitable. This combination of a flexible, trouble-free on-tap fuel and a service which has been perfected over a century of growing industrial utilisation will ensure that gas will keep abreast of technical progress for many years to come. Indeed, over the past ten years sales of gas to industry have increased by 30%, and according to a recently published Gas Council booklet, Gas Looks Ahead, they are expected to increase by a further 20% during the next six years.

The exhibition is being divided to show the following main features: Heating liquids, heat treatment, glass working, automatic glass fabrication, flame heat treatment, high temperature radiant heating and gas burners, metal melting, low temperature radiant and convection heating, baking, and ancillary equipment. That, however, is a bare outline. A detailed review of the exhibition appears on the next page, and in this we have attempted to prove the point with which we began this editorial—that this exhibition reveals gas as an industrial fuel of the future.

We believe this exhibition is something which nobody concerned with the application of heat in industry should miss. We regard it as an exhibition of the utmost importance, as indeed the first exhibition bearing this title proved to be three years ago. On that occasion visitors totalled 10,000; this time the number may well be higher. And it is of interest to note that gas boards are still getting new business as a result of that exhibition, and the publications produced for distribution on that occasion are still in demand. This time the organisers have produced even more impressive literature, and it is hoped that the feature article we have produced this month will complement this, as well as providing some consolation for those not fortunate enough to get to the Horticultural Hall.

The exhibition will remain open until March 12, but readers in the north of England will have an opportunity to see a version of the exhibition at Harrogate between March 28 and April 1. We understand that this will have many of the features of the London show with the addition of new demonstrations of development work and a special textile feature. It is being presented jointly by the Northern and North Eastern Gas Boards.



Space rockets or crisp loaves — wherever precision is vital, one finds

GAS AT WORK IN INDUSTRY

ONE of the features of the British gas industry is that while it has its roots firmly fixed in the past it also has its sights set firmly on the future. So far as the place of gas in industry is concerned, it follows that gas-fired equipment of all kinds is not only giving every satisfaction in the old-established industries and processes but is also equally indispensable in the exciting new industries which are keeping Britain in the forefront of technological advance.

Although it may not always be apparent to the outside observer, gas is playing a vital role in such new industries as nuclear engineering, radar, television and electronics, jet-age air transport and space travel It is equally concerned in furthering the striking advances which are currently being recorded in the field of automation.

There is an urgent need for these successes of the gas industry to be more widely publicised, and it is for this reason that the Gas at Work in Industry exhibition deserves to be warmly welcomed by all those who realise the value of the contribution the industry is making towards the national economy.

Colourful picture

Sponsored by the Eastern, North Thames, South Eastern and Southern Gas Boards, the 1960 exhibition, at the Royal Horticultural Hall, London, presents a colourful and up-to-date picture of the present state of the industry. An examination of the various stands and features leaves the visitor in no doubt as to the extent to which the gas industry is breaking new ground in applying gas to the most

By
ERIC FORD

important heat processes of the present time.

Behind the decision to organise this exhibition, as a sequel to the highly successful 1957 event which was seen by no fewer than 10,000 visitors, lay the desire of the organisers to bring to industrialists an up-to-date appraisal of what the gas industry has done and is doing to provide new and efficient plant for both new and existing processes. In particular, the industry is anxious to show how gas-fired plant can now be designed to fit into continuous production lines while other gas-fired equipment will enable former manual processes to be converted to automatic production.

A powerful corrective for those who may still feel that gas, as a source of heat, may be in danger of succumbing to more recently developed media can be seen on the central feature of the exhibition which conclusively demonstrates the part which gas is playing in the most up-to-date of industrial developments.

Models, pictures of plant and examples of actual equipment illustrate the work of gas in many new industries which make heavy demands on gas, particularly where processes are continuous and precise control is essential, as is normally the case in all these industries.

In the manufacture of the well-known Zeta apparatus, for example, town gas was extensively used, notably in the annealing of components, such as the toroidal cores. Annealing took place at 800°C., the total treatment time being 24 hours in an atmosphere consisting of nitrogen with 10% added hydrogen. The gas-fired furnace employed had floor dimensions of 27 ft. by 12 ft. 6 in.

Aircraft components

Many hundreds of aircraft components, from air frame sections to the smallest metal parts of engines, have to be heat treated, and gas is widely used in this application. With the higher speeds and greater heights required by the jet age, new materials are required, necessitating more accurate heat treatment techniques. Both in the manufacture and fabrication of these new high duty materials, gas, with its well-known capacity of flexibility and ease of control, is in growing demand.

In the aircraft industry, where the number of separate components re-

quiring heat treatment can easily run into hundreds for each aircraft, it is not only necessary to have an efficient source of heat but it is also essential that this heat-source shall be capable of utilisation in complex automatic and semi-automatic production lines. It cannot be too often emphasised that this is precisely the most important feature of the new equipment coming forward in the gas industry today.

New heat processes

Dr. Barnes Wallis, Chief of the Aeronautical Research and Development Department of Vickers-Armstrongs (Aircraft) Ltd., recently spoke of planes of the future which would be capable of travelling well over 11,000 miles non-stop at speeds of four-and-a-half times that of sound. The surface skins of such planes would be exposed to temperatures up to 300°C., thus spot-lighting the need for new materials and the use of new heat processes to produce and subsequently treat them.

Gas will find its place in the treatment of these materials of the future, as it is already being used in the production of the new materials of today, such as the nimonics, plastics and man-made fibres.

Automation is a word which strikes fear into some as it conjures up thoughts of an Orwellian world of the future in which men and women become merely machine watchers; on the other hand, it holds out the promise of greatly increased production, leading to greatly improved living standards all round. Whichever view is likely to be proved correct, it is certain that gas is already playing a big part, both in the production of the equipment which makes automation possible and in the automatic processes themselves.

Electronic devices

For example, electronic devices of many different kinds are widely employed in automation and gas-heated precision plant is specially designed for use in the electronics industry where it is used in the production of valves, transistors and many other components.

Cathode ray tubes have a multitude of uses, both in the home and in industry. Precision-controlled gas flames are widely used in the manufacture of these tubes, which are vital to the success of radar. An interesting example of this is seen on the central feature at the exhibition where a film showing the use of radar in short-term weather prediction is in continuous operation and a closed-circuit television installation demonstrates the increasing value of this means of supervision.

Inevitably, no single feature could hope to capture the complete contribution which gas is making to modern industry. The visitor to the exhibition's central feature, however, will soon realise that the industry is continually solving new problems in its attempt to supply the industrialist of today and tomorrow with a source of heat which will enable him to turn out a better product more efficiently.

There may have been a time when the sole function of the gas industry was to maintain an adequate supply of gas and to pipe it in appropriate quantities and at the requisite pressure to the consumer.

Now, in addition to the manufacture and supply of gas for industry and the general public, the gas boards are closely concerned with the development of equipment to make the maximum use of gas in any application for which it is suitable. In this side of its activities, the gas boards work in close conjunction with the various firms throughout the country which specialise in the manufacture of gas-fired plant and ancillary equipment.

A great deal of the latest types of this equipment is on show at the exhibition where it can be seen in action on a number of typical operations including heat treatment, the heating of liquids, glass working and fabrication, flame heat treatment, high temperature radiant heating and gas burners, metal melting, low temperature radiant and convection heating and baking.

In the metal using industries, heat treatment is a factor of obvious importance and the stand devoted to this aspect of gas-fired equipment is particularly impressive. Because of space limitations, the equipment on show is mainly for small-scale applications but it presents a good cross-section of the main processes, all of which can be equally well applied to operations of the largest type.

Because heat treatment is such an important activity in virtually every manufacturing industry, it is particularly necessary that costs should be cut as far as possible, and the gas industry has especially addressed itself to the end. This explains the current trend towards continuous operation in heat treatment processes, where large numbers of similar components may be subjected to identical treatment which lends itself to automatic or semi-automatic methods.

Another trend, which adds up to a similar result in terms of economics, is the greater use of prepared atmospheres in heat treatment furnaces which obviate the subsequent need for further cleaning and other correcting processes.

A particularly interesting example of specialised heat treatment on display is the demonstration of vitreous enamelling on aluminium, such as is required in the manufacture of small ware, such as nameplates, ashtrays, badges, jewellery and the like. It is believed that this particular process has not been done on a production basis before, because the process takes place at a temperature very near the melting point of aluminium.

Low temperature 'frit'

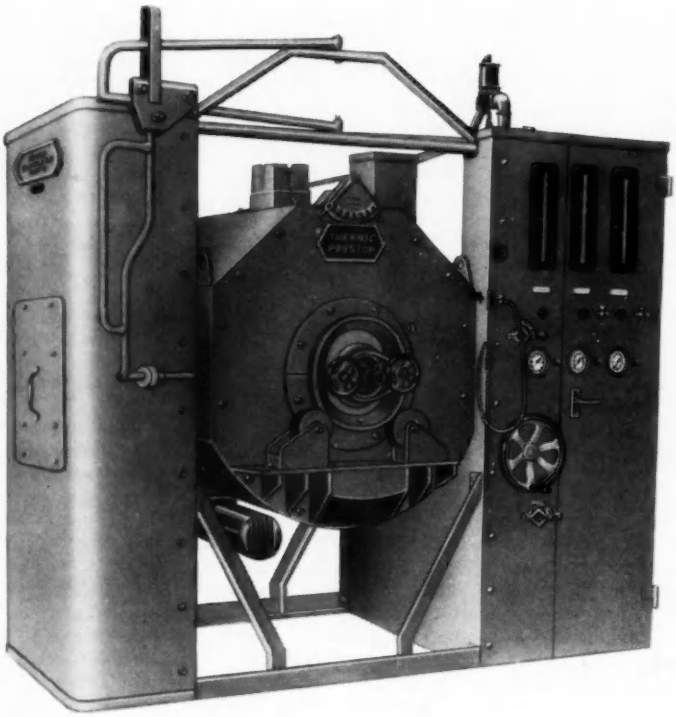
Ferro-Enamels Ltd. have developed a special low temperature 'frit' for spraying on the wares which complete the process in a vitreous enamelling furnace supplied by the Incandescent Heat Co. Ltd., Birmingham. This furnace incorporates the high recirculation radiant tube elements,

You must see the second

Gas at Work in Industry Exhibition

sponsored by Eastern, North Thames, South Eastern and Southern Gas Boards

ROYAL HORTICULTURAL HALL, VINCENT SQUARE, LONDON, S.W.1, MARCH 1—12.



Rotating retort furnace for gas carburising and carbo-nitriding manufactured by Thermic Equipment & Engineering Co. Ltd., in collaboration with Gibbons Applied Atmospheres Ltd.

known as Jetubes, which have been developed by this company.

In these tubes, a gas and air mixture is burned in a refractory-lined section. The products of combustion leave this chamber through a nozzle at high velocity. In so doing, they entrain the hot gases already circulating in the body of the tube and so build up recirculation.

High turbulances

This system has many advantages. The recirculating gases protect the tube from the high temperature gases leaving the nozzle and troublesome hot spots are completely avoided. The gas velocity in the tube is many times that which would be obtained if the gases were injected at one point and exhausted at another after a single pass. The high turbulance gives intimate mixing, which also results in the avoidance of hot spots. Resultant high mass flow within the tube gives very high heat transfer rates. Moreover there is very little temperature drop over the whole element, so that heating is fast and even, and the Jetube can be operated with a comparatively low temperature lead. Additional efficiency may be obtained by fitting a small recuperator to each Jetube.

Although the Jetube-fired vitreous enamelling furnace on show at the exhibition is being employed on small objects, the flexibility of the Jetube permits the same furnace to be used for the complete range of enamelling processes. It should be noted that the exhaust gases are used to heat a small drying oven mounted on the furnace proper.

Jetubes can be fitted to many different types of furnace, of course, and the emphasis on vitreous enamelling at the exhibition is only an indication of the versatility of this important new piece of equipment for the gas industry.

Bright brazing of small parts, such as are used in the manufacture of water heaters, is being demonstrated on another piece of equipment on the heat treatment stand. This is the gas-fired conveyor wire mesh type furnace manufactured by Dowson & Mason Ltd., Manchester.

With an overall length of 22 ft., the furnace comprises a charging length of 1 ft. 9 in., an inlet zone (4 ft. 6 in.), a heating zone (4 ft. 6½ in.), a cooling zone (9 ft. 2½ in.) and a discharge length of 2 ft. Width of the furnace is 2 ft. 10 in. and the overall height from floor level to the top of the flue stack is 8 ft. 5¼ in.

This furnace is capable of an output of 80 lb. per hour of non-ferrous pressings and gas consumption at 800°C is approximately 300 cu.ft. per hour. Maximum gas burner capacity is 400 cu.ft., which is capable of raising the furnace from cold to the operating temperature in 1¼ hours.

A Dowson & Mason Ltd. furnace has been installed at the new industrial showrooms of the East Midlands Gas Board for about six months, where it is used for exhibition, demonstration and test purposes.

Hump back

A feature of this furnace is the hump back design of the muffle, the purpose of which is to retain the prepared atmosphere in the muffle as it will tend to hold to the highest point by virtue of its natural buoyancy and leakage to the external atmosphere is much less than if the whole of the muffle were on a common level. It is reported that a striking economy in the volume of atmosphere gas is realised.

In addition to the purpose to which this furnace is being put at the exhibition it is of interest to consider two other applications for which this type of furnace is being used in industry, as yet one more example of the versatility of gas in heat treatment applications. One such application, of a fairly straightforward character, consists of the annealing of small brass pressings to form the cases of instruments, such as pressure gauges, vacuum gauges, volt meters and ammeters. The protective atmosphere ensures the elimination of scale.

Valve grids

A second application is much more unusual and very well typifies the extent to which gas is penetrating the more recent industries. The furnace in question is in current use by a company for a heat treatment process in the manufacture of radio valves. The grids of the valves, after assembly, have to be heated in a hydrogen atmosphere both to drive off occluded oxygen from the surface of the metal and also to anneal the assembly and remove work hardness caused in the assembly. Thanks to this, they can subsequently be placed on small expandable mandrels and stretched to obtain a very close degree of dimensional accuracy which, it is claimed, is within a tolerance of 0.0005 in.

In this way, the company ensures uniform performance characteristics of their valves. This particular furnace has been giving entire satisfaction for a considerable time, both in

TIME OUT OF MIND

Now with the help of Horstmann gas controllers (or electric time switches with solenoid valves) you can get rid of all those niggling little doubts so often associated with space heating.

Times for switching gas heating on and off can be put right out of your mind and the whole procedure—whether you are there or not—can be left with complete confidence and safety to a Horstmann Controller. Once set, the controller will automatically continue to operate according to its pre-set schedule for as long as you wish; and apart from its convenience this ensures that heat is not wastefully produced when it is not needed. In most cases special time schedules can be arranged for advancing or delaying operations on any specified day or days.

Type V Time Switch

Time switches are available for the control of electric circuits for gas fired central heating and warm air systems.

The Horstmann 3A/UNI controller has been specially adapted for use with small bore gas fired heating systems by the addition of a neat 5 amp. switch. It automatically turns the gas ON and OFF and at the same time operates the electric water circulating pump. Either a synchronous motor driven movement or hand wound movement can be supplied.

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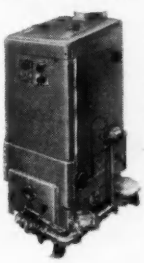
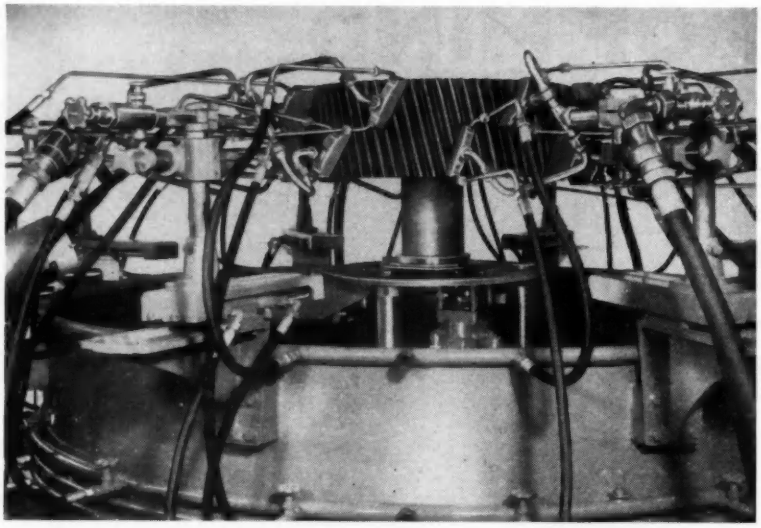
Left. Horstmann 3A UNI Controllers are invariably fitted to Kayenco model P45.D.L. gas fired boilers.

Right. 'Vertex' gas fired industrial central heating boilers for requirements up to 300,000 B.Th.U.s per hour, are regularly fitted with Horstmann 3A/UNI Controllers.



Manufacturers who fit Horstmann controllers to their central heating equipment include The Beeston Boiler Co. Ltd., Frederick Kay Ltd. Glow-Worm Boilers Limited, Hattersley Brothers Ltd., Heatinaire, Ideal Boilers & Radiators Limited, Thomas Potterton Ltd.

HORSTMANN



An important advance in the design of flame hardening plant is represented in this recently perfected spin hardening method (Peddinghaus Patent). This equipment, which is marketed by Surfard Ltd., saves time and serves to eliminate human error in results.

the uniformity of treatment and the remarkably small consumption of hydrogen.

Dowson & Mason Ltd. rightly point out that the value of the retention of the protective atmosphere is not entirely a matter of economics. Many such atmospheres are either explosive, such as hydrogen, or highly toxic in their CO content, and therefore the less likely it is to leak to the surrounding atmosphere, the safer are working conditions.

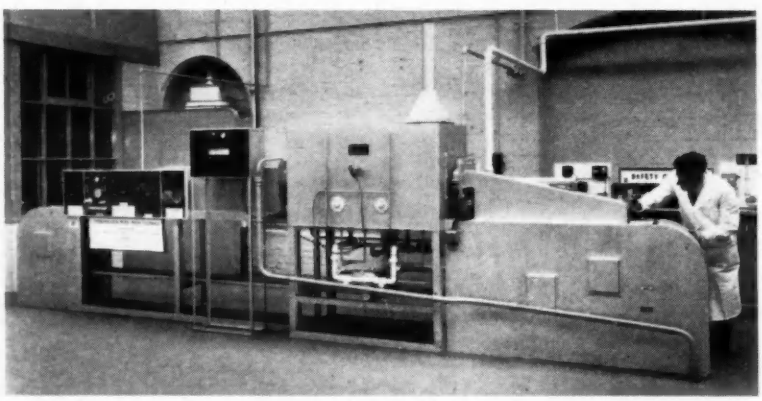
Gas carburising and carbo-nitriding applications are of increasing importance in many industries, particularly perhaps the automobile, aircraft and similar industries. An impressive example of this type of furnace is on show at the exhibition in the G.A.A.-Thermic rotating retort furnace. This equipment represents a new approach to gas carburising, carbo-nitriding or clean hardening of small steel components, such as the steel tips for footwear which are being so treated at the exhibition.

In collaboration with Gibbons Applied Atmospheres Ltd., Thermic Equipment & Engineering Co. Ltd., Preston, have developed this simple rotating retort furnace which provides the highest standard of process atmosphere control and uniform heating in a small, compact, simple to operate combined furnace and controlled atmosphere plant. In addition to their low capital cost, these furnaces can be built into multi-units, thus obtaining the maximum amount of heat treatment facility for the minimum amount of factory space.

Fired by noiseless Thermic high velocity tunnel burners applied to a specially shaped chamber, the furnace provides uniform heating conditions throughout the retort from end to end to within 5°C., plus or minus.

This packaged unit is complete with all the required propane, ammonia and air flow gauges and mixing devices for the control of the furnace atmosphere, so that once the packaged unit is delivered, production can commence within 72 hours of arrival. Temperature control is provided by two Electroflo ElectroniK Edgewise indicating controllers, by Electroflo Meters Co. Ltd. The main control takes place within the furnace metal retort, the additional instrument acting as an overrider to prevent the external heating surface of the retort rising greatly in excess of the pre-set point in the retort.

Clean heat treatment is also demonstrated on the stand in a shaker hearth furnace for case hardening or surface carbon collection on plan by British Furnaces Ltd., who are also showing a MRX 500 atmosphere gas producer.



Gas-fired conveyor wire mesh type furnace by Dowson & Mason Ltd. Furnaces of this type are finding many applications in brazing, annealing of pressings and other heat treatment operations where a protective atmosphere is essential.

Surface hardening

Surface hardening of many components of modern equipment is necessary to meet the heavy duty conditions experienced at points of heavy wear. Examples are the teeth of gear wheels and the contact surfaces of camshafts. In the motor vehicle industry in particular, and in the manufacture of much earthmoving and other contractors' plant there are numerous components where such surface hardening by direct flame heating, followed by quenching, is most effectively carried out by town gas.

There are two main directions in which gas-fired equipment for flame heat treatment is being developed to give improved performance. In the first place, equipment is being devised which applies the heat at precisely the right point and for the correct period of time.

Automatic methods

A second line of development is the increasing introduction of automatic methods into flame hardening procedures. As many of the components which are normally subjected to this treatment, such as motor car gears, for instance, are in mass production, the importance of automatic operation of the flame hardening is of great importance to managements.

These two trends are clearly seen in the equipment on display on the stand

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A Radiation COMPANY

at the exhibition which is devoted to flame heat treatment. The Peddinghaus flame hardening unit, supplied by Surfard Ltd., London, is a particularly good example. This recently perfected spin hardening method is a great time-saver and guarantees accurate and uniform treatment of gears of all sizes.

Surfard Ltd. flame hardening equipment is available in several sizes according to requirements. The gear which is to be treated is placed on a central rotatable spigot which is also capable of rising and falling in order to lower the gear into a quench tank and to lift it again after quenching. The quench tank is built into the equipment and cooling equipment maintains the oil at the correct temperature. The heat is provided by a number of oxy-town gas burners arranged round the perimeter of the gear to be hardened. All the operator has to do is to place the gear in position on the spigot and remove it at the completion of treatment.

When a gear is loaded, the pressing of a switch causes it to rotate, the gas and oxygen valves supplying the burners are opened and the heating cycle begins. When the tips of the teeth reach the maximum hardening temperature, a Milliscope automatic temperature control, which has been pre-set at the required temperature, brings into operation a patented pulsating device which partly closes the oxygen supply whilst allowing the heat to penetrate to a chosen point below the roots of the teeth. This depth may be pre-set by the time-switch which the milliscope operates. In this way, the depth of heat penetration is always constant.

Quench bath

On the closing of this time-switch, gas and oxygen are shut off and a pneumatic valve opens to lower the heated gear into the quench bath. As the gear enters the quenching oil, another time-switch comes into action so that the gear remains in the oil for a pre-determined period. When quenching is complete, the gear is raised once again to the starting position; the spigot meanwhile has ceased to rotate and the flame treated gear is removed in readiness for the commencement of the next cycle of operations.

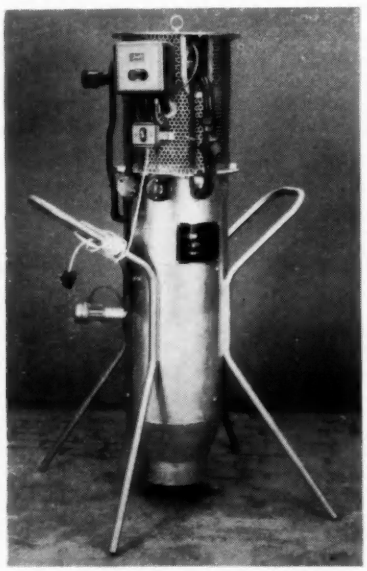
As an example of the speed of operation of this unit, it has been demonstrated that a gear made from EN19 width diameter 8¼ in. and tooth width of 2⅞ in. had a floor-to-floor time of 3¼ minutes.

Flame cutting and profiling machines are widely employed throughout industry because of the substantial reduction in machining time, which represents a considerable number of man-hours in many workshop procedures. At the exhibition, the use of oxy-town gas for cutting steel is being demonstrated by equipment supplied by Hancock and Co. (Engineers) Ltd., Croydon. The electronically controlled machine cuts to shape either direct from a drawing or by following a template.

In the smaller workshop, of course, hand cutting can be carried out using oxy-town gas burners for manual operation. Whatever the cutting method employed, town gas has the advantage of producing a very clean cut and freedom from slag adhesion. This has been found to be particularly the case with carbon and alloy steels.

Accuracy

Soldering and brazing operations are among the most common of activities in any assembly shop, ranging from relatively straight-forward operations with hand torches to complex automatic plant for mass production work. Among the advantages of gas in all these operations is the accuracy with which the flame can be directed to the point required, namely, the surfaces in contact with the jointing material. Machines supplied by Standard Telephones and Cables Ltd., Sidcup, demonstrate this at the exhibition. These two fully automatic machines are respectively engaged on the treatment of car engine valves and components for thermostats and are working on a cyclic arrangement with automatic control of time and temperature.



Used for mould drying in foundries with great success, this axial jet gas-fired hot air unit is produced by Modern Furnaces & Stoves Ltd.

Finally, in the flame processing field, there is the increasingly important process of spraying metal powders to achieve a desired finish or for anti-corrosion purposes. For the spraying of tin, lead, zinc, aluminium and copper, operating costs are said to be lower than with any of the other suitable gas while the enrichment of town gas by other gases of higher flame temperature offers little additional advantage. A metal spraying unit by Metallisation Ltd., Dudley, demonstrates this interesting process at the exhibition.

It is reckoned that of the total gas consumed by industry, about 20% is used for heating liquids of one kind or another. Hot water and steam are used for a large number of processes while many processes require the heating of non-aqueous liquids, such as oil, fats, waxes, bitumen and many other materials.

In some trades, such as metal finishing, it is estimated that the costs of heating may be as high as 15% of the total process costs. To quote but one example, in the plating trade, gas-fired appliances are very widely employed both for heating the various 'dips' and for such preliminary processes as degreasing in trichloethylene baths.

Immersion tubes

A great deal of research has taken place in recent years into the heating of liquids with a view to improving the operational efficiency of the equipment. As a result, efficiencies have been approximately doubled without undue extra initial costs for the purchase of the plant. The introduction of immersion tubular heating is one example of the work in this field.

Typical of the steam raising equipment which is capable of being fired by gas is the size 6SR controlled flame boiler shown by Controlled Flame Boilers Ltd., London, in the section of the exhibition devoted to heating liquids. This particular boiler is designed for a maximum working pressure of 120 p.s.i.g. and is for smaller evaporative capacities, but similar boilers are produced by the company for considerably higher pressures to meet special requirements.

In heating, as in every other type of gas-fired operation, the emphasis is on automatic control and a particularly interesting feature of this boiler is the electronic level control which has been developed by Controlled Flame Boilers Ltd. This system starts and stops the electrically

driven Conflux L.S. Type feed pump according to evaporative demands and gives audible and visible warning, plus safety fuel shut off, on low water conditions. It automatically re-establishes with normal water level and gives similar audible and visible warning and fuel cut-out on extra low water level. The automatic lock remains until normal water level is again attained and the control has been manually re-set. There are no moving parts in the level sensing portion of this apparatus.

Constant pressure

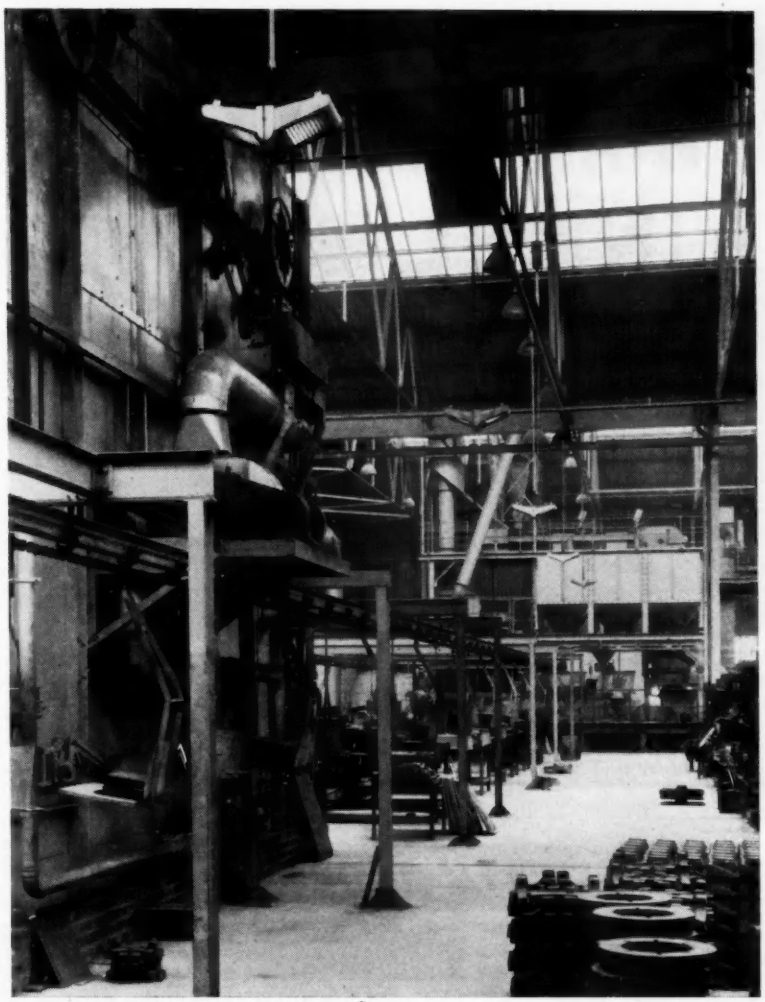
Pressurestat control is of the type produced and employed by the makers for many years and a constant pressure gas governor and low pressure gas cut-off valve are housed under an inspection plate in the platform at the exhibition but would normally be installed in the gas service line in the most convenient position. The Conflux L.S. Type pump is a development of the standard unit which embodies the advantages afforded by modern materials.

Controlled Flame Boilers Ltd. supply similar units for evaporation ranges of 47 to 349 lb. of steam per hour in the vertical range, but horizontal boilers are produced in a standard range for evaporations up to 3,000 lb. per hour and special units are designed and produced to meet exceptional demands.

Gas-fired equipment is continually finding new applications in established industries as well as in the newer ones. An example of the former is the use of gas-fired plant in the treatment of textiles, notably the new man-made fibres. At the exhibition, Sanderson & Company (Textile Engineers) Ltd. are showing an autoclave which has applications in this field. Many of the more recent artificial fibres require heat setting at critical temperatures and town gas has provided a solution to the heating problems involved. The recent fashion trend towards pleating has made the heat treatment problem still more urgent in the textile industry.

Adequate supplies of hot water have always been a vital necessity in all sections of the food trade and more particularly in the preparation of such items as hams and other forms of meat. A good example of a piece of gas-fired equipment for the preparation of hams can be seen at the exhibition in the form of the size No. 6 Ajax ham cooker, manufactured by W. J. Hubbard & Sons Ltd., London.

A striking rise in the popularity of the so-called broiler has recently given a new slant to the poultry industry. The essence of this trade is the rapid and economic treatment of large numbers of small-size birds and the industry is organised on mass production lines. In such cases, a bottle-neck can easily occur at the plucking and cleaning stages, where large numbers of birds require to be stripped with the speed necessary to get the birds on to the market in time.



Heating of industrial premises is efficiently and economically effected by gas. Bratt Colbran Satellite suspended overhead industrial heaters provide comfortable working conditions in this large installation.

It has been found that a suitable hot water spray makes the subsequent plucking operation much easier, whether this is done by hand or machinery, and furthermore the condition of the final product is much improved. The important point about the broiler, in addition to its suitable size for modern consumer tastes, is the fact that it is an exceptionally tender bird and therefore the way in which the feathers are removed affects both the speed of the operation and the condition of the bird's skin after feather removal.

There can be no doubt that the broiler conditioning plant shown at the exhibition by Cope & Cope Ltd., Reading, will arouse considerable interest among those concerned in the rising broiler industry.

Liquid heating

In an exhibition of this kind it is obviously impossible to cover the entire range of liquid heating by gas-fired plant and the demonstrations are confined to applications requiring hot water and steam. In addition to the specialised equipment already mentioned, the stand also contains a gas-heated water tank, supplied by Neil & Spencer Ltd., Leatherhead,

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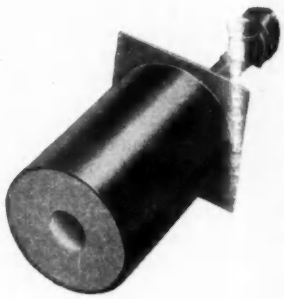

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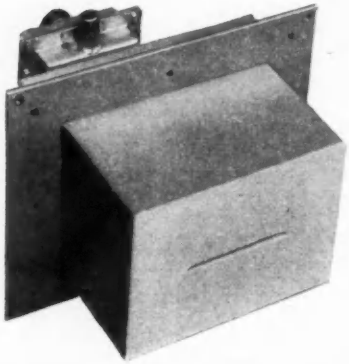

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which is fully instrumented to give automatic operation and demonstrates very clearly the high efficiencies obtainable with one simple burner.

Although glass working and fabrication still contains a great deal of intricate and highly skilled manual work, an efficient source of heat is required at all stages. The part which gas can play in this ancient industry with a modern outlook is well demonstrated at the exhibition where, in addition to much intricate equipment, craftsmen of George Springham & Co. Ltd., Harlow, are seen making scientific ware from high-grade borosilicate glass.

In glass manufacture, gas-fired equipment is employed both in the original melting of the ingredients (a process known as founding) and in the subsequent operations, such as annealing, the 'cracking off' of superfluous parts, the fusing of any sharp edges, final polishing operations and so forth.

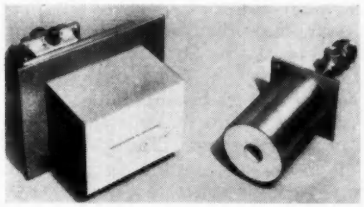
Various types of burners for use in glass working are on show at the exhibition which also contains a forced circulation oven, by J. L. S. Engineering Co. Ltd., Redditch, for use at critical temperatures close to the melting point of glass, to relieve stresses. This particular process is of special importance when making complex scientific glassware when failure during an important experiment in the laboratory may result in the loss of important results or danger to personnel.

Radio valves

There is no need to emphasise the growing importance in the modern world of electric lamps and radio valves which are required in their millions, both for domestic and industrial applications. The processes associated with the mass production of these items require the application of heat within very fine limits by precision gas flames for the shaping, sealing and other operations. Because of the vast numbers of these items which are produced, accurate automatic procedures are essential and gas-fired equipment provides this feature and also ensures the delicate application of flame required.

Two flare forming machines supplied by Thorn Electrical Industries Ltd., Enfield, demonstrate some of these features on the stand, particulary the way in which heat input and flame shape can be accurately maintained to give the necessary high output with a low percentage of rejects.

Among the earliest uses to which gas was put in manufacturing industry, metal melting must obviously have taken an early place. It is still a very important application, and there can be few engineering works which do not have some gas-fired metal melting equipment, even if it is only a small melting pot in the corner of one workshop. Throughout industry as a whole, of course, there are many types of externally and internally heated furnaces, both for the melting of metals and for the processes of tinning and galvanising.



B-W air blast tunnel burners by Barlow-Whitney Ltd. Circular discharge is for medium temperatures (to 500° C.) and slot discharge for high temperatures (to 1,500° C.).

In all these applications, gas has many advantages, including flexibility, ease of control and high process efficiency. Equipment on show at the exhibition includes a model Z100 bale out furnace and an A.R.200 reverberatory melting furnace, both supplied by A.G.M. Industries, London. An IMP96 diecaster, manufactured by Alfred Herbert Ltd., Coventry, demonstrates the value of gas-fired melting equipment for this important industrial process. A demonstration of diecasting itself is being given by the well-known firm of Diecast Alloys Co. Ltd., London.

With the greatly increased use of tinned copper strip, this process is of considerable present-day importance. This is essentially a mass-production operation and is particularly suitable for gas-fired equipment. Indeed, so large is the normal output of an automatic gas-fired tinning bath, that the exhibit by the South Eastern Gas Board has had to be demonstrated at the exhibition in hand-operated form as otherwise the vast quantities of strip which would have been produced could not have been accommodated in the exhibition hall!

Catering

Some visitors to the exhibition may feel inclined to wonder where industry begins and ends, but although definitions may vary, there can be no doubt that the organisers were right to include the sections on catering, flour confectionery and heating and hot water in the exhibition. The use of gas for cooking and ancillary purposes is as eminently suitable where services are performed on a large scale as when the fuel is employed in the domestic kitchen. With more and more people either eating away from home or consuming food products at home which have been fully or partly cooked by specialist firms outside, the supply of prepared food is more properly considered as an industry and a growing industry at that.

It therefore follows that the firms which provide these services must do so on properly organised industrial lines and, of course, many leading food firms have been doing just this for many years. The aim of the catering exhibit at the exhibition was to show the part which gas can play in the improved organisation of catering establishments of varying sizes.

In presenting this feature, the organisers have clearly laid the emphasis on the planning service which the gas industry offers, under which gas-fired equipment plays an important part in providing the basis of the careful planning which must precede the re-organisation of a kitchen along scientific lines. The 'Plan a Kitchen' campaign sponsored by the Gas Council was an important link in this process and models of the winning entries are displayed on the stand.

Fat fryer

With so much equipment available, it has been possible to select only one example to demonstrate the improvements which are available. A deep fat fryer, supplied by Metal Units Ltd., provides an excellent example of the type of equipment, fired by gas, which brings greater output at lower gas consumption to the catering industry.

On this stand, too, is a new type of caloric incinerator, by Radiant Heating Ltd., London, which is particularly suitable for the lighter duty likely to be encountered in the smaller catering establishment. Dial type thermometers by the Accurate Recording Instrument Co. Ltd., London, are also displayed.

Despite the many dietary discoveries of the present day, ranging as they do from the theories of marathon-walker Dr. Barbara Moore to the juicy steak beliefs of many athletes, statistics show that bread is still the staff of life, with the many other products of flour occupying a prominent place in the diet of ordinary mortals. In the preparation of such items as bread, breakfast cereals, biscuits, sweets and chocolate, gas equipment has many overwhelming advantages, including the most obvious ones of cleanliness and ease of control.

This is particularly well demonstrated at the exhibition by the model

bakery on which the well-known West-End firm of Floris Bakeries Ltd. is daily putting on the most mouth-watering exhibit of the entire exhibition. The equipment they are using for the actual baking operation is a Royal double degree oven and its versatility is demonstrated by the fact that Floris Bakeries are using it to produce both bread of various kinds and confectionery. This oven is manufactured by Cox Ovenbuilders Ltd., Leamington Spa, one of the companies of the Flavel Group.

A medium-sized two-deck oven, the Cox Royal, will accommodate four 30-in. by 18-in. trays, or approximately 50 2-lb. loaves per deck. Steam dampers and inspection windows are fitted to the two doors which are situated off-centre to facilitate loading and unloading of the ovens without tilting the trays. Each deck is fitted with built-in electric light.

Direct-reading thermometers of the circular type give readings for each deck. The double degree oven is available with separate heat control to each deck, permitting baking to take place simultaneously at two different temperatures.

Model bakery

Although the gas-fired oven is the heart of the model bakery, the skilled staff on duty require much other equipment for the production of bread and other products. The equipment in use includes a moulder by the Record Bakery Equipment Co. Ltd., dough mixer by the Hobart Manufacturing Co. Ltd., prover and steam boiler by the Ellerstyle Engineering Co. Ltd., divider by the Robertson Bakery Equipment Co. Ltd., and scales by W. & T. Avery Ltd. An Argyll hotplate by Stoves Ltd. is also in use on this attractive stand.

By the use of a heating source at an appreciably higher temperature than that to which the work is to be heated, and by the control of the final temperature of the work solely by the time of heating allowed, rates of heat transfer many times greater than those attained in the standard convection oven can be obtained. For this reason, radiant heating offers great possibilities in the speeding up of many industrial heating operations, including, in particular, drying, curing, softening and fusing. Because the object to be heated is required to pass a certain amount of time in the rays of the heat source, it follows that the operation can be accurately timed and lends itself particularly well to mass production techniques.

This latter point is especially well demonstrated on the stand devoted to high temperature radiant heating where a new high temperature radiant heat plant, by Stewart Gill & Co Ltd., Slough, is being used for the enamelling of badges made by the well-known firm of Fattorini & Sons Ltd., Birmingham. This is a fully automatic plant with a large output and well illustrates the conveyorised application for which radiant heat furnaces are particularly valuable.

Among the ancillary equipment on this stand is a Hippo wet bandfacer machine, by the R. J. H. Tool & Equipment Co. Ltd.

How gas-fired equipment can speed up the core drying process is also shown on this stand in a demonstration by F. & M. Supplies Ltd., using a new high speed core drying oven manufactured by Radiant Heating Ltd., London.

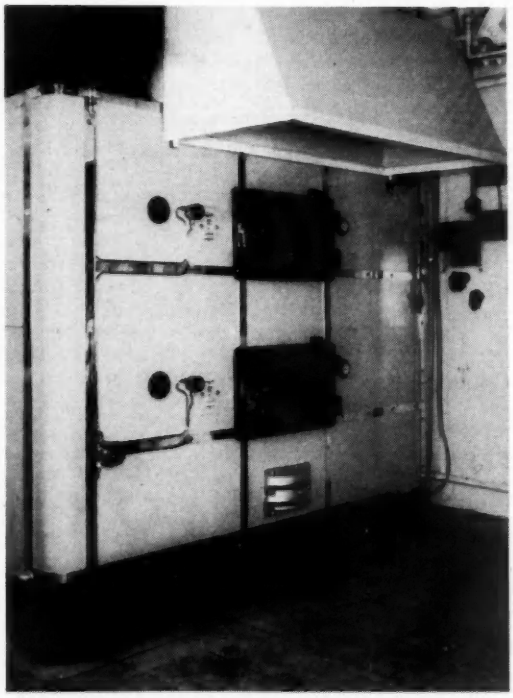
Taking the exhibition as a whole, the painstaking and knowledgeable visitor could no doubt locate almost every important type of industrial gas burner somewhere or other on the various equipment on show. Most visitors, however, will probably prefer to examine the display of burners on the section of the stand devoted to this subject where the items vary from a burner with less than 500 B.t.u. per hour output to one with an output of over 1 mill. B.t.u. per hour.

A display of B-W tunnel burners, representing the latest in high intensity gas heating for faster production, by Barlow-Whitney Ltd., London, is of particular interest. These burners, which are of compact design and incorporating own combustion chamber, have exceptionally high velocity and temperature (1,650°C.) of discharge which makes them equally suitable for direct local convention heating or for installation in complete industrial plant, such as boilers, furnaces, ovens and other plant, using jet recirculation.

A separate stand at the exhibition is devoted to low temperature radiant and convection heating. Low temperature heating covers a very wide range of processes and some of the most important of these are illustrated. For example, many firms require the services of a reliable batch-type oven for such duties as baking, curing, drying, pre-heating, softening, stoving, vulcanising and general processing requirements up to temperatures of about 300°C. The B-W industrial batch oven, by Barlow-Whitney Ltd., meets these requirements.

Air convection

Features of this type of oven are the forced air convection which ensures good temperature distribution and improved heat transfer, and the automatic temperature control. An explosion relief panel and flame failure device ensures safety in operation. The particular model on show at the exhibition is a tray loading unit, but trolley loading and larger versions are also available.



An up-to-date piece of gas-fired equipment for the bakery. Operated at the Gas at Work in Industry Exhibition by Floris (Bakers) Ltd., this two-deck oven is by Cox Ovenbuilders Ltd., a company of the Flavel Group.

Air heating units for many different duties can be most conveniently fired by gas. Consider, for instance, the method of continuous drying of cloth or paper which can be economically and efficiently carried out by equipment supplied by Harris Engineering Co. Ltd., London. A typical drying plant will comprise a Harris 1½-therm direct-fired gas plenum heater, discharging warm air downwards from duct outlets into folds of cloth suspended in festoons on a suitable conveyor system.

This method can also be applied to the drying of wallpaper after printing, although, in this case, the air may sometimes be discharged at the bottom of the folds of paper where it is more moist. Plant of this type has many other industrial applications suitable for direct gas firing.

Harris direct-fired heaters are normally available in a range from 1½ therms to ten therms per hour. Each heater comprises a combustion chamber, fan and motor, Davy gauze air inlet filters and non-return louvre shutters, together with the necessary control gear. The combustion chamber is fired by Hypast gas burners which are ignited automatically by a high voltage spark ignition system operated in conjunction with a photo-electric flame failure control and is also controlled by a modulating thermostat, overheat control and air pressure switch.

Foundry moulds

Another application for gas-fired air heating units is in the drying of moulds in foundries where a new piece of equipment by Modern Furnaces & Stoves Ltd., Birmingham, is already proving entirely satisfactory. The unit is of mild steel construction with an outer casing ending in a conical nozzle to give increased velocity to the outgoing gases.

A natural draught gas burner is fitted inside the casing and is arranged to burn in a heat-resisting steel combustion chamber which is placed concentrically inside the casing and allows an annular space between the two cylinders for the passage of the air to be heated.

An axial type fan of ample capacity keeps the outer casing cool while at the same time projecting a jet of high velocity hot air through the outlet nozzle at the bottom of the unit. The mould dryer has a gas consumption of approximately 850 cu.ft. town gas per hour and delivers 500 cu.ft. of hot air per minute at temperatures up to 400°C.

Equipment of this type, which is likely to be in continuous action for lengthy periods, must be safe in operation. Flame failure control comprises a probe of special heat-resisting alloy which is positioned to enter the combustion chamber and an electronic manual re-set unit to cut off the gas supply in case of failure and which will only allow for re-setting after a purging period of 20 seconds.

Drying-room heating units are very effective when gas fired, and a typical example is on display at the Exhibition, the equipment in this case being by A. E. Griffiths (Smethwick) Ltd.

Stoving tunnels

Radiant tunnels are particularly useful for stoving of any articles or components which can be conveyed through them, for instance, by means of overhead conveyors to which the items to be stoved can be suspended or otherwise attached. A particularly interesting example of what can be done in this way is demonstrated at the exhibition, using a radiant tunnel supplied by Parkinson Cowan Industrial Products Ltd., London.

This tunnel is used for the stoving of small toys by the very well-known toy manufacturers, Lines Brothers. In association with the operation, a spray booth by the Aerograph Co. Ltd., is employed and the conveyor used in conjunction with the tunnel is by Teleflex Ltd. The entire installation is an excellent example of the economic and efficient use of a radiant heat tunnel on continuous production operations.

Two forced recirculation ovens manufactured by F. J. Ballard & Co. Ltd., Tipton, are used in another interesting flow line application in which refrigerator parts are impregnated in a plastic material. The parts are first pre-heated in one of the ovens and then move over a plastic powder and flotation tank supplied by the Telegraph Construction & Maintenance Co. Ltd. (Plastics Division), Farnborough. The tank rises automatically and by so doing the part to be coated is dipped in the powder which adheres to it because of the pre-heating. The tank then falls automatically and the part, now coated in the plastic material, passes into the second oven for curing. The entire plant has been specially developed for this process which, it is believed, has not been carried out on a production scale before.

It is all too easy to regard the factory as a place where a particular product is manufactured and to forget the many heating requirements necessary for the service of the factory itself. With the vagaries of the British climate, the heating of a factory is an important consideration and with the increasing attention to welfare in modern industrial life, hot water is also a regular need. Very many firms manufacture gas-fired equipment for heating and hot water supply and only a few of the better-known concerns can be mentioned here.

In recent years, the use of overhead radiant heaters has increased considerably, due to its recognised advantages which include the more rapid achievement of comfortable conditions required for working in all weather conditions.

A leading firm in this sphere is Bratt Colbran Ltd., London, whose products include a range of overhead industrial gas heaters with thermal inputs from 7,500 to 70,000 B.t.u. per hour. These are available in a variety of forms for wall or roof-suspended fixing.

Equally successful in this field is the firm of Parkinson Cowan Industrial Products Ltd., which also offer roof suspended or wall-mounted radiant heaters for industrial use, as do Radiant Heating Ltd.

Examples of all these can be seen at the exhibition where other industrial heating plant includes the balanced flue convector heater by F. A. Borchardt Ltd., Chiswick, and the Dravo No. 40 air heater (Powell Duffryn Modulair Ltd., London).

It is a similar story in regard to hot water supply by gas-fired equipment, for a number of well-known manufacturers and suppliers are engaged in this important field, such as Ascot Gas Water Heaters Ltd., London, whose Model 709 instantaneous multi-point water heater is known to many factories, and Radiation Ltd., whose hot water storage sets and sink storage water heaters are well known. Examples of these can be seen at the exhibition as well as gas-fired water heaters by Ewart & Son Ltd., London.

Gas-fired boilers

Gas-fired boilers for commercial and industrial use are in regular employment in many factories, such as the range of Kayenco boilers manufactured by Frederick Kay (Engineering) Ltd., Chesham. The 'S' series, for instance, ranges from sets of 30,000 B.t.u. rating to 800,000 B.t.u. These boilers are ideal for industrial use, being supplied complete with burner and automatic controls comprising regulating governor, cut off relay, thermostat, thermo-electric pilot flame failure auto cut-off valve and thermocouple. They also have an integral pilot ignition system, pilot supply governor, burner control cock, and pilot control cock. They are on the Gas Council approved list.

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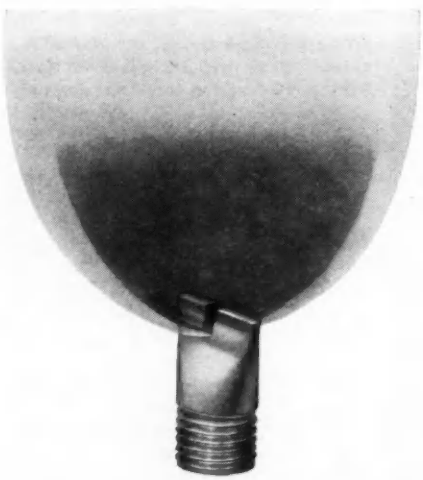

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taking place in the field of industrial water heating as in any other section of the gas equipment industry. R. & A. Main, for instance, have introduced a new multi-purpose instantaneous water heater, known as the Main Triton. It has been designed with a view to ease of maintenance and cleaning and versatility in operation. A particular feature is the incorporation of a draught diverter within the casing, with streamlined escape outlets in the sides of the heater.

Gas has also entered the domestic 'chores' field, where these are encountered on a large scale, as in industrial canteens. A dishwashing machine, by Dawson Brothers Ltd., Woodford Green, is gas-fired. Small incinerators, for factory use, can be supplied by such firms as Southalls (Birmingham) Ltd. and William Sugg & Co. Ltd., London.

As everyone knows quite well, most gas-fired equipment incorporates a great deal of important ancillary plant, such as instrumentation, fans, compressors, electric motors and the like. The firms which supply this equipment make a great contribution towards the success of the gas industry, but it is not possible to pay adequate tribute to the work of these firms within the scope of this survey.

A gas compressor

Keith Blackman Ltd., London, can be quoted as a very good example of this type of firm, as a great deal of this company's equipment can be seen at the exhibition. Some of this equipment is working in conjunction with that of other exhibitors. For instance, a B4 gas compressor driven through V-ropes by a Keith Blackman anti-pulsation valve and a Keith Blackman oil separator is providing the gas supply to the flame hardening unit by Surfard Ltd.

Tornado fan equipment of various types, all supplied by Keith Blackman Ltd. is supplying air for combustion purposes to various furnaces in action at the exhibition.

In addition to their role in supplying ancillary equipment of this type, Keith Blackman Ltd., are also suppliers of gas equipment in their own right. They have recently introduced a compact air blast tunnel burner which is having its first ever showing at the exhibition. It is particularly interesting to note that this apparatus is the result of initial research carried out by the Gas Council and its Midland Research Station, with subsequent development work by the Keith Blackman Industrial Gas Research Department. It is designed to achieve speedier combustion and higher temperatures with accurate control in the furnace and is particularly suitable also for high speed localised heating purposes such as in the treating of bars and plates.

In operation, the gas-air mixture is delivered to the burner by an injector which, though based on the principles of the standard, well-established design, incorporates certain modifications which tests have proved to be extremely effective. The injector is fitted with air and gas connections and a gas adjuster to ensure the correct mixture at the burner orifice.

So far as compressors for use with industrial gas equipment are concerned, it is necessary to go no further than the name of Broom & Wade Ltd. This well-known firm has a great deal of its equipment at work in various parts of the exhibition.

It is thus clear that very many firms are playing their part in supplying equipment for the gas industry. The equipment so supplied depends for satisfactory operation upon the supply of town gas forthcoming in adequate quantities from the various gas boards, four of which have collaborated to sponsor this exhibition. But the rôle of the gas boards extends much farther than merely supplying the gas for in every part of the country. Firms who use gas in their operations can rely upon the services of the practising technicians and engineers, supported by research and development workshops, to assist in the solution of problems concerning their use of the public gas supply.

This service is much wider than ensuring that gas flows to the equipment and performs its duty correctly. A firm which requires advice on a heating problem, or which wishes to make modifications to existing gas-fired plant can call upon the appropriate industrial gas engineer for advice. Further than that, if it is a question of undertaking extensive development work into a new gas application, the services of the industrial gas departments are at the disposal of the client.

Optimum results

In carrying out this side of its work, a gas board will co-operate with plant manufacturers in new design and development work in order to ensure that the ultimate customer obtains equipment which is technically and mechanically sound and produces the optimum results which gas can give.

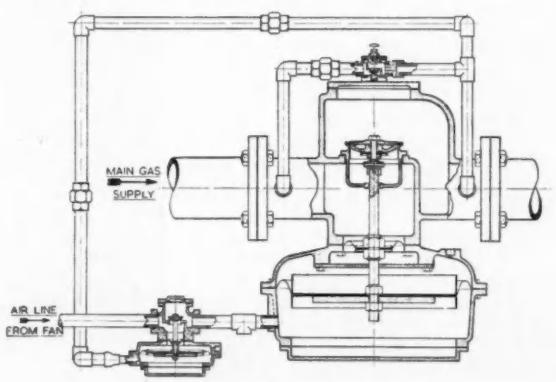
GAS/AIR CUT-OFF VALVE

TYPE J62 Patent gas/air cut-off valve has been designed to protect personnel against the formation of explosive mixtures in furnaces and other appliances following the interruption of either gas or air supply.

Operation is as follows: On failure on either of the two mediums, the main hemispherical valve would fall to its closed position. On restoration of supply the burner cock(s) should be closed and the small manually-operated valve depressed, which will result in gas passing from the inlet to the outlet side of the main unit. The gas will commence to build up and pass via the pipe-work to the underside of the main diaphragm of the auxiliary gas failure valve.

As a result, the hemispherical valve of this unit will open, allowing air pressure to pass to the large diphragm of the main unit which will open and allow the full gas stream to pass to the appliance.

Valves, which are made by Jeavons Engineering Co. Ltd., Tipton, Staffs., can be supplied in sizes ¾ in. to 12 in. inclusive and are suitable for air or gas pressures up to a maximum of 20 in. w.g. Higher pressures can be accommodated.



Sectional arrangement of the valve.

CREMATION

A RESUME OF PROGRESS TO DATE

From a paper presented to the Scottish Junior Gas Association

by ***A. HIGGS,***
M.Inst.Gas E., M.Inst.F.

AREA INDUSTRIAL GAS SALES DEVELOPMENT OFFICER, SCOTTISH GAS BOARD

GAS is used very extensively in crematoria throughout this country. In fact, of the 137 crematoria in operation, 131 or 95.5% use gas-fired cremators. An indication of the growth of the cremation movement can be gleaned from the fact that, in 1947 61,160 cremations were carried out, in 1957 107,149, and in 1958 over 168,000 cremations were completed. The growth of the movement, therefore, has been extremely rapid.

Cremation was officially approved in this country by the passing of the Cremation Act in 1902, although several crematoria had in fact been erected and operated before that time; in fact the first was at Woking in 1885.

Smoke emission

After the passing of the Act the cremation movement started to develop more rapidly and in 1905 cremators of French design, known as the Toisoul-Fradet, were installed at Lawnswood, Leeds, and also at Bradford. These cremators were constructed substantially of firebrick and had a solid hearth, the coffin and the charge being placed on a metal tray in the furnace, the tray being removed when the cremation was completed. The waste gas flues were carried beneath the cremating chamber hearth, under the floor, and thence to a chimney stack. Although cremations were completed the air input was hardly sufficient to result in rapid oxidation of the charge. The burner equipment employed was of the natural draught type, firing from the rear end of the cremation chamber, and smoke emission was inevitable.

In 1917 the Toisoul-Fradet type of cremator was redesigned by Lockwood and installed at West Norwood. The modified cremator had the burners fitted at the front end and employed the first open grid hearth to be used in this country. This resulted in a substantial improvement.

In 1923 Askam and Company Ltd. introduced their natural draught cremator and a number of these were installed in various parts of the country. This cremator had an open grid hearth with burners in the ash chamber below, the combustion products and hot air passing upwards through the charge, and thence through apertures in the arch to the chimney stack. Top burners firing into the annular space between the two arches helped by heating the flueways, and contributed in some measure to reducing smoke emission. This design was perhaps advantageous in those instances where electrical power was not available, although, as might be expected, the reliance on chimney draught for air induction made the cremation times rather lengthy and smoke control difficult. From 1923 until 1952 a number of cremators were on the market including the Gibbons & Co. Ltd., Rogutt cremator with top burners, an improved Askam cremator with air blast burners fitted in the side walls, and the Radiant Heating & Co. Ltd., cremator with burners in the side walls, all of which represented improvement on the previous types.

About this time, after representations from the cremation movement, considerable thought was given by the gas industry to improving cremator design to completely eliminate smoke emission and substantially improve the efficiency of gas application. This work was centred around the Lawnswood crematorium in Leeds, and the Golders Green crematorium in London, where work was carried out in conjunction with the Industrial Departments of the North Eastern Gas Board, the West Midlands Gas Board, and the North Thames Gas Board respectively.

Unifurnaces Ltd.

Thought was also given to the problem by certain furnace manufacturers, in particular by the Incandescent Heat Co. Ltd., of Birmingham, and by Unifurnaces Ltd., of Ascot.

Unifurnaces Ltd., evolved a cre-

Three Diamond cremators at the Golders Green crematorium.

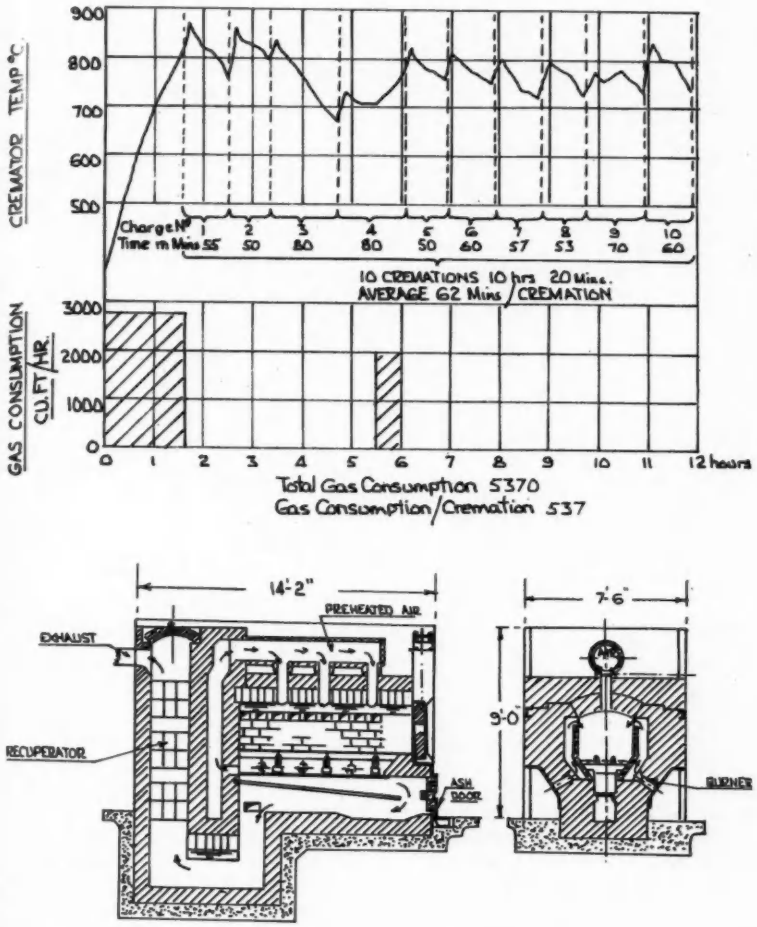


Fig. 1. Top, a typical day's performance of the Uni-cremator by Unifurnace Ltd. Below are sections of the cremator.

mator with a number of novel features, the main one being the use of a shell of silicon carbide which formed an inner chamber. The general design is portrayed in Fig. 1. This shell was heated by a surrounding combustion chamber into which burners entered the cremating chamber proper through ports situated along the top of the side walls, and where mixing took place with preheated air entering through ports in the roof. Intense combustion resulted, and the products of final combustion were drawn down through the hearth into a sloping ash chamber.

The liberal use of silicon carbide, which is a good heat conductor, provided after pre-heating, incandescence of the whole of the shell of the chamber, and therefore speeded cremation without flame contact. The exhaust gases passed from the ash refining chamber into a recuperator chamber where heat was transferred to the incoming combustion air. The recuperator of the needle type was of Newton Chambers manufacture, and provided when operating in continuous service, a preheat temperature of up to 400°F.

This cremator represented a very substantial step forward on existing designs, but was more expensive by virtue of the recuperative arrangement, and also required to be effectively preheated before cremation could commence.

Incandescent Heat Co. Ltd.

The cremator designed by the Incandescent Heat Co., Ltd., incorporated regeneration, and was the first regenerative type of cremator to be marketed by a manufacturer in this country. The general design is shown in Fig. 2. Regeneration is standard practice on a number of furnaces marketed by the Incandescent Heat Company and other furnace manufacturing companies, and this system provides a means of extracting the maximum heat salvage from the outgoing waste gases. The Incandescent cremator was a fully automatic unit with automatic change-over of the regenerators, and incorporated 11 neat gas burners on each side of the furnace arranged in line with uptake ports on the regenerative system. To facilitate preheating, and to ensure safety, gas was burned on both sets of burners at all times, the gas from one set of burners firing into the regenerators, while the opposite burners fired across the cremation chamber. The automatic regenerator change-over mechanism operated every 60 seconds, and the design allowed large volumes of air to pass through the combustion chamber, when necessary, to meet the peak demands of the cremation process. The multiplicity of air ports above and below the charge gave intimate contact with the charge, and so accelerated combustion. A large exhaust fan was used to maintain a negative pressure in the combustion chamber at all times—a most desirable feature. The furnace design was such as to give speedy cremation with a minimum gas consumption, and with elimination of smoke emission. The use of regenerators would require considerable excavation work with a proportionate higher capital cost.

Process requirements

The North Eastern Gas Board cremator was designed after considerable investigation into the basic requirements of the cremation process, and also of the wishes of the cremation movement. These remarks apply equally to the Diamond cremator, so named in acknowledgment of the work of Mr. G. le B. Diamond, Chairman of the West Midlands Gas Board, and chairman until recently of the London Cremation Co. Ltd., who contributed much to the technical progress of the cremation movement for many years. Basically the conditions sought were as follows:

(1) That the cremator should positively and completely eliminate the emission of smoke.
(2) Cremation should be carried out speedily and completely.
(3) The cremator should be economical in gas consumption, be simple to operate and require the minimum of maintenance.
(4) The cremator should be finished externally to comply with the aesthetic requirements of a modern crematorium.
(5) The cremator should be reasonable in capital cost.

As might be expected in an investigation of this type, attention was given, as with all industrial problems,

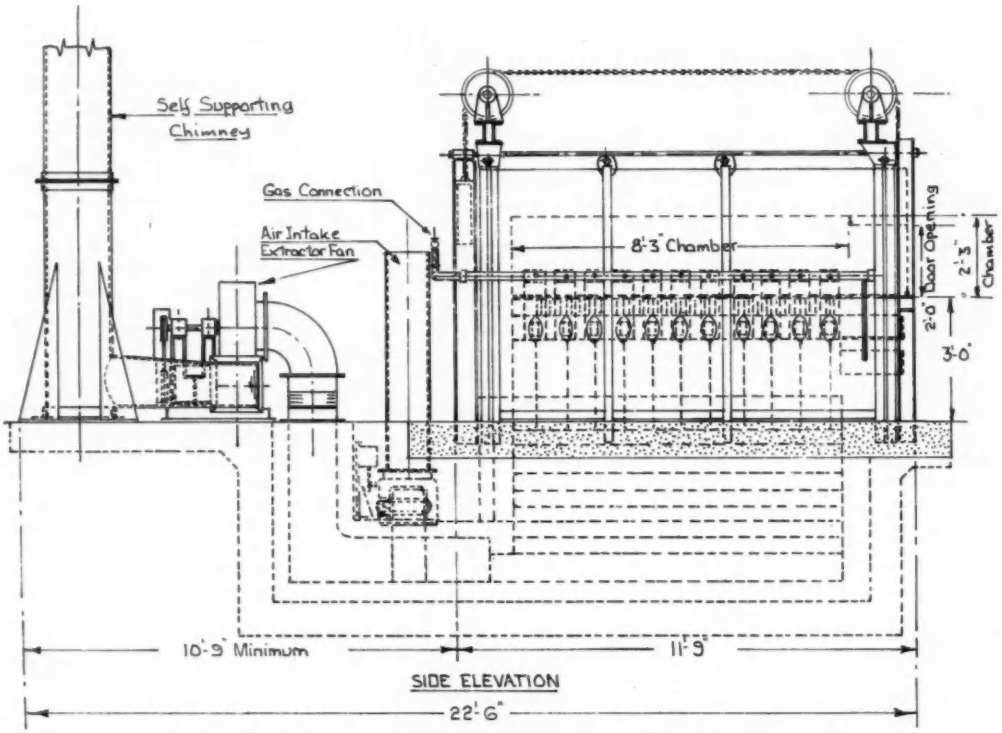


Fig. 2a. Side elevation of the cremator by Incandescent Heat Co. Ltd.

to the heat requirements and peculiar features of the process. Higgs, Anderson and Pearson, in their paper 'The cremation movement in Great Britain, with special reference to cremator design,' presented to the Public Works and Municipal Services Congress on November 5, 1952, gave the figures in Table I in respect of heat available from an average body and coffin.

These air requirements are for perfect atomisation, whereas in actual practice the nature of the charge renders it impossible to obtain intimate mixing so that the use of an excess of air is unavoidable. A number of factors control the maximum air requirements at any instant, and the actual volume of air that must be furnished in order to cover the peak requirement is dependent on three main factors: (1) The state of the body, i.e., the cause of death and the presence or otherwise of high calorific value combustible materials in the coffin, that is, coffin wax or pitch; (2) the intimacy of the mixing of the air with the charge and with the evolved combustible gases; and (3) the temperature at which the cremator is operated for optimum results.

TABLE I.

	Weight lb.	*Heat available from charge* B.t.u.
Elm coffin	90	542,000
Average body	144	369,000
		Total 911,000
Less heat required for the evaporation of moisture content of body	80	92,064
Net heat available		818,936

The theoretical air requirements were also calculated over the complete cremation cycle and they are listed as follows:

		Weight lb.	*Air required cu.ft. per lb.*	*Total cu.ft.*
Elm coffin		90	63	5,670
Body	Carbohydrates ...	.88	59	6,733.7
	Fats	27.78	156	
	Proteins	28.88	74.5	
	Salts	6.62	29.7	
	Water	80.0	—	
Total for body and coffin ...				12,404

The state of the charge is most important from the aspect of air requirements. The peak air demand can be very large indeed for short periods in the early part of the cycle, due to the presence of pitch, coffin wax and other combustible material, and the state of the charge. Some charges are in a state where fierce combustion results, on subjection to contact with the air at the right temperature, while others, particularly where a long illness has obtained, may call for heavy supplementary heating to complete disposal of the remains from which the combustibles have been largely depleted. The intimate mixing of air with the charge calls for a suitable disposition of air/burner ports, and while a very large number with independent control might be advantageous, a balance has to be made, in practice, between practical operating requirements and the advantages arising from a larger number of ports.

Peak air needs

The temperature of operation is of course most important and has a very strong bearing on the peak air requirements of the process. Different combustible materials have various ignition temperatures, and the higher the temperature at which cremation is carried out the larger the amount of

material that will be ignited simultaneously; hence the air requirement of a cremator may be up to 18 times greater than that required for burning the maximum gas consumption provided for. In the absence of recuperation, of course, it is essential to control this excess air flow, as otherwise a cooling effect can result with increased gas consumption.

The Lawnswood Ne-Gas cremator

After careful consideration of the foregoing, and after carrying out a flow pattern study using plastic models, the North Eastern Gas Board constructed a prototype cremator to the design shown in fig. 3 at Lawnswood crematorium, Leeds. This prototype had multiple ports in the inner arch, or crown, of the main chamber, through which air was directed on to the charge, and 32 nostril blocks, or air discharge ports, were provided in three rows of eight.

Rapid heating up

A neat gas burner system was arranged in the centre row with independent control. The furnace, apart from the load-bearing surfaces, was lined with insulating refractory to give a low thermal capacity and afford rapid heating up with the minimum gas demand for preheating; this arrangement also ensured the rapid attainment of cremation temperatures.

An open grid hearth was employed, and all combustion products flowed through this hearth along an ash hearth, and then via bottom flues away to the stack, and a negative pressure was ensured on the cremator at all times by the employment of a refractory ejector system in the flue, the air to the jet being fed from the standard burner and combustion air blowing fan.

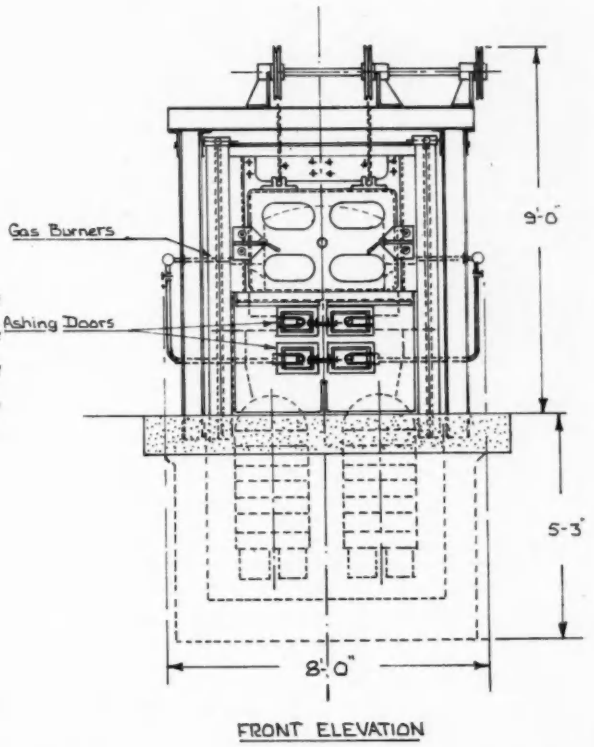


Fig. 2b. Front elevation of the Incandescent Heat Company cremator.

TABLE II.

	Time taken	*Gas Consumption*
First cremation	1 hr. 25 min.	Total gas
Second ,, ...	55 ,,	consumption
Third ,, ...	50 ,,	for
Fourth ,, ...	55 ,,	five
Fifth ,, ...	45 ,,	cremations
Total time	4 hr. 50 min.	1,900 cu.ft.
Average time: 58 min.	Average gas consumption: 380 cu.ft.	

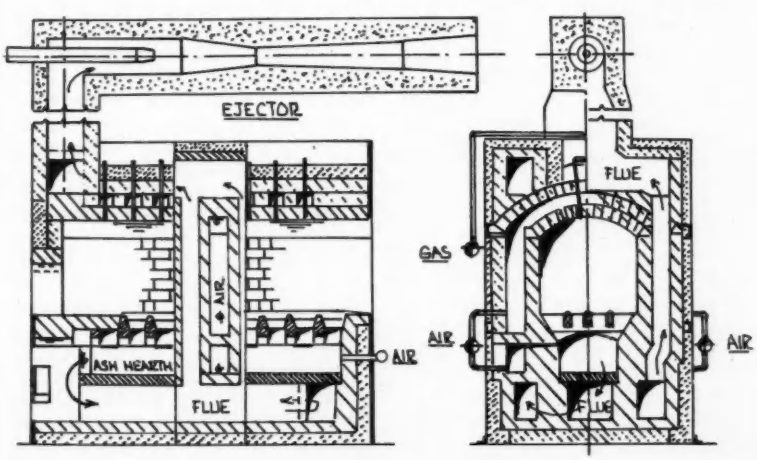


Fig. 3. Prototype Lawnswood Ne-Gas cremator.

Distillation process

Cremation is, to some extent, a distillation process, and a considerable volume of combustible gases are evolved in the upper chamber. In the Lawnswood Ne-Gas design, air was provided under the hearth with supplementary burners so that the combustion of these gases was effectively completed and smoke emission eliminated. The maximum provision of air on this prototype was 45,000 cu.ft. per hour at 14 in. w.g., which was about three times as much as provided previously on any cremator. The performance represented a substantial improvement and Table II gives figures typical of a day's performance.

Dowson and Mason single cremator

The design was patented and the North Eastern Gas Board licenced Dowson & Mason Ltd. to produce commercial versions of the cremator. Very considerable progress has been made by Dowson & Mason since that time and their latest reference book—'Cremationis Scientia'—fully records the progress made and provides a wonderful guide to all concerned with cremation.

Fig. 4 shows the Dowson & Mason design of a single cremator. You will note that the main difference from the prototype is the elimination of the second two rows of air nostril blocks in the crown and the fitting of one central row of burners and air ports. The same principle of hearth construction is retained, that is, a refractory open grid hearth, combustion products flowing, as in the prototype, to the lower ash hearth where adequate air is provided to complete combustion of the evolved gases. Combustion products are vented via flues, built into the side walls, to top collecting flues, and two ejectors are fitted as an integral part of the cremator instead of the one separate ejector as on the prototype. The use of the ejector system ensures that a negative pressure is maintained in the combustion chambers at all times, so eliminating the possibility of spillage of combustion products into the furnace room proper.

Considerable attention has been paid by this company to the finish of the cremator, and a streamlined furnace casing is fitted with charge doors having a satinised aluminium front plate, with a bezel of polished aluminium of attractive appearance. All the controls are grouped at the rear of the cremator, together with the instruments indicating temperature and draught, and the cremator is extremely simple to operate. The usual safeguards are included for failure of the air blowing fan, and manual resetting is necessary after a shut-down. Twin cremators of this design can of course be built side by side in one casing with a common centre wall, this giving some economy in capital cost.

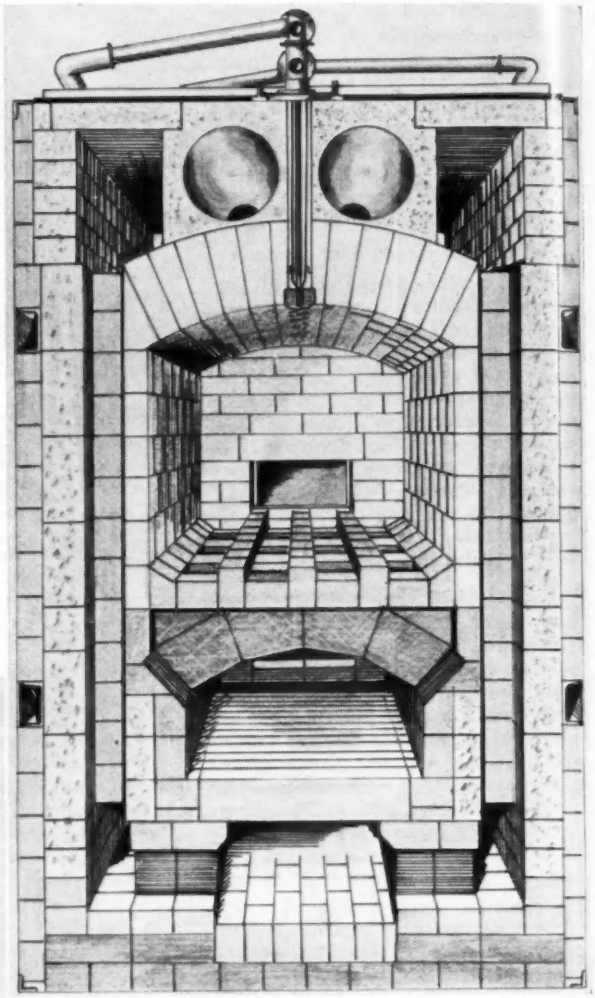


Fig. 4. Dowson & Mason single Ne-Gas cremator.

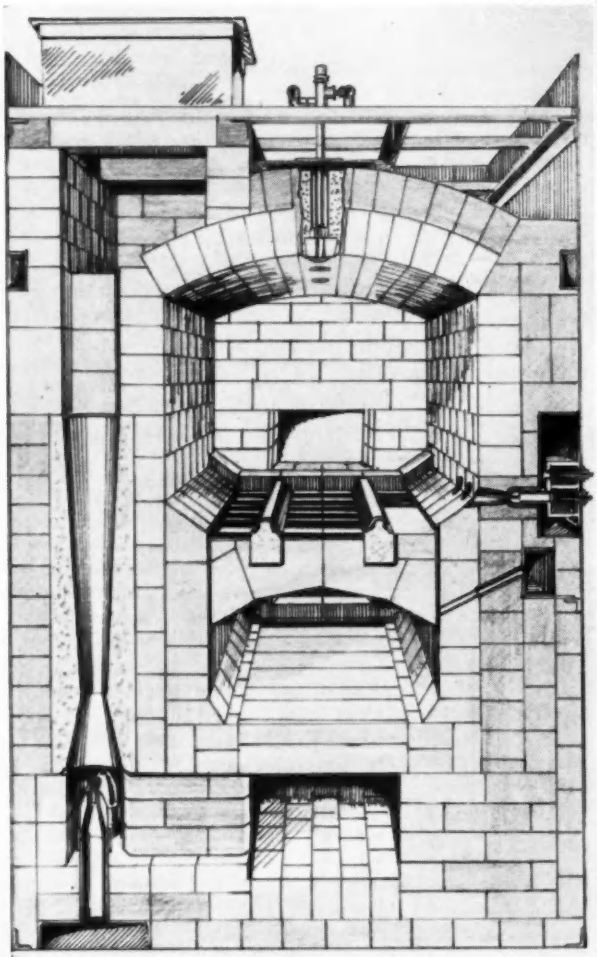


Fig. 5. Dowson & Mason Eltham cremator.

The Super Twin cremator

This is a development of the twin cremator, the principle being the reclaiming of some of the heat evolved during the normal cremation cycle with consequent economy in gas con-

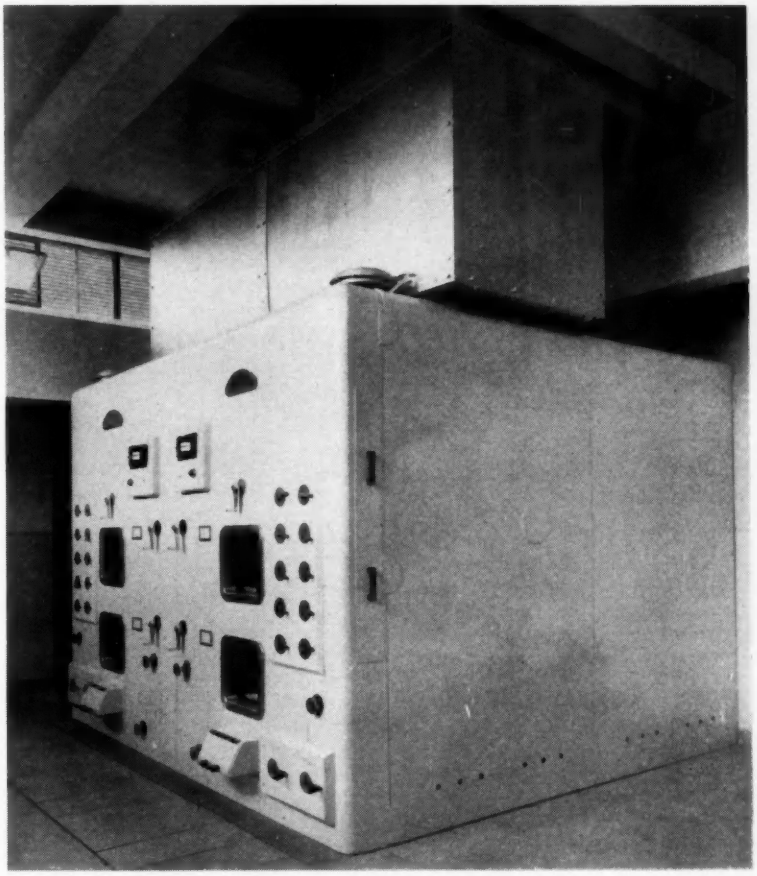
sumption. During the first portion of the normal cremating cycle, for approximately 20 minutes, combustion is rapid as the bulk of the combustibles are consumed during this period and the Super Twin cremator is designed to make use of the waste heat which would normally leave the cremator during this time. In the Super Twin, therefore, there are inter-communicating ports in the common wall between the two cremation chambers through which the hot gases and flames from the No. 1 can be drawn through into the No. 2, and *vice versa*. The waste gases from one chamber can, therefore, be used to preheat the other chamber or to start up a cremation, and by reversal at appropriate times economy in gas consumption is achieved. In fact the average gas consumption on this type of cremator is reported to be of the order of 100 cu.ft. per cremation. It is of course desirable, when using the Super Twin, to achieve full fuel economy and ensure that cremations follow on; in general it is only advantageous to fit a Super Twin in busy crematoria.

The Eltham Lawnswood cremator

This is a modified version of a standard Lawnswood Ne-Gas cremator, and, as will be noted from Fig. 5, the arrangement is basically the same as with the standard cremator, except that the ejectors are built into the side wall of the cremator and concentrated combustion burners are fitted in the side walls in addition to the normal burner system fitted in the crown. This arrangement, it is reported, still further increases the speed of cremation.

The Dowson & Mason company have made a large number of installations over the last few years and they have replaced a number of electrically-heated furnaces at the Mortlake Crematorium. Electric cremators are substantially slower than gas-fired cremators and maintenance costs are higher. In fact a figure of £500 per annum per cremator is frequently quoted.

One of the improvements effected recently by Dowson & Mason is the incorporation of automatic suction control in the main chamber of the cremator. This improvement affords economy in fuel consumption with improved working conditions. The control is achieved by means of a sensitive switch having a neoprene diaphragm with a balancing spring and an adjusting knob for the control of the sensitivity. A connection from below the diaphragm to the cremation chamber results in an upward or downward movement of the diaphragm in response to changes in pressure conditions. This diaphragm movement makes or breaks electrical contacts and causes a fractional h.p. reversing motor connected to the suction air control valve to operate until balanced conditions in the cremating chamber are restored.



Two Diamond cremators installed at the North-East Surrey crematorium.

The Diamond cremator

Work was proceeding at almost the same time, both at Lawnswood and the Golders Green crematorium where the West Midlands Gas Board, in conjunction with the North Thames Gas Board and the London Cremation Co. Ltd., constructed a prototype cremator. The first cremator, to the design of which the late Mr. J. F. Waight, of the West Midlands Gas Board, contributed, in consultation and co-operation with the Chairman of the London Cremation Co. Ltd., incorporated recuperation, that is, preheating of the air supply by the outgoing waste gases by the conventional medium of passing the gases over a bank of specially treated steel tubes fitted above the arch, and this was used in conjunction with a system of neat gas firing. This first prototype design did not fulfil the desired objectives, as laid out earlier, but it did provide very valuable information on the merits of employing recuperation, and on the advantages to be derived from various types of burner equipment, which led to the construction of the second prototype cremator in September 1955.

Recuperation is not practised in the final prototype, but careful attention was given to the selection of refractories to afford a low thermal capacity. The burner equipment on this cremator received particular attention. and the burners in the main chamber are located in the arch firing downwards towards the hearth at high velocity, and special attention was paid to ensuring stable combustion conditions at all times.

A heat resisting steel hearth is employed with spacings which allow only the ashes to fall through to a carefully designed ash collecting hearth which also acts as a container for any liquids

evolved in the early part of the cremation. The ash refining chamber is separately heated and the powerful air blast burners fitted effectively reduce any residual wood ash and whiten the fine residue. The ashes fall through the refining hearth to an air cooled chamber where they are cooled before finally being withdrawn. The combustion products flow down through the heat resisting steel hearth and two rows of air jets, arranged vertically, discharge towards the centre of the dished ash hearth and effectively burn off evolved gases, although a second bank of air jets in the side return flues is provided to deal with 'exceptional cases'.

Teleflex controls are fitted to give separate control over the five powerful top burners and primary air supply points, with motorised control by push button of the main under hearth air supply. Particular attention has been given to the finish of the cremator and to ensuring minimum noise level, and silent sliding doors are fitted at the rear end of the cremator to give access to the main chamber and ash hearths. A special ash collecting box is provided and the main chamber door is counterbalanced. Fig. 6 shows the design of cremator and also records a typical day's performance. The cremator is designed on a streamlined flow basis and a negative pressure applies in the combustion chamber at all times. The design is patented, and the West Midlands Gas Board have licenced Gibbons Askam Ltd. who have built since 1955 a considerable number of cremators to this design. A feature worthy of note is the low maintenance costs. Several crematoria have completed 1,275—3,947 cremations without maior repair.

Crawley crematorium

A new cremator has been installed at Crawley crematorium, designed by Charles A. Lewis, formerly of Radiant Heating Ltd., and now Sales Manager of Standard Sales Ltd. The cremator has only recently been installed so that performance details are not available but, briefly, the furnace employs six air blast burners arranged three in each side wall in staggered formation, so as to make intimate contact with the charge. A shaker grate in mehanite heat resisting cast iron is arranged in the ash pit chamber with operation from the side of the furnace, and it is submitted that this ensures that the material reaching the refining chamber is of small dimensions. Separate burners and air jets are provided for final calcination with an air supply under pressure to a final refining chamber.

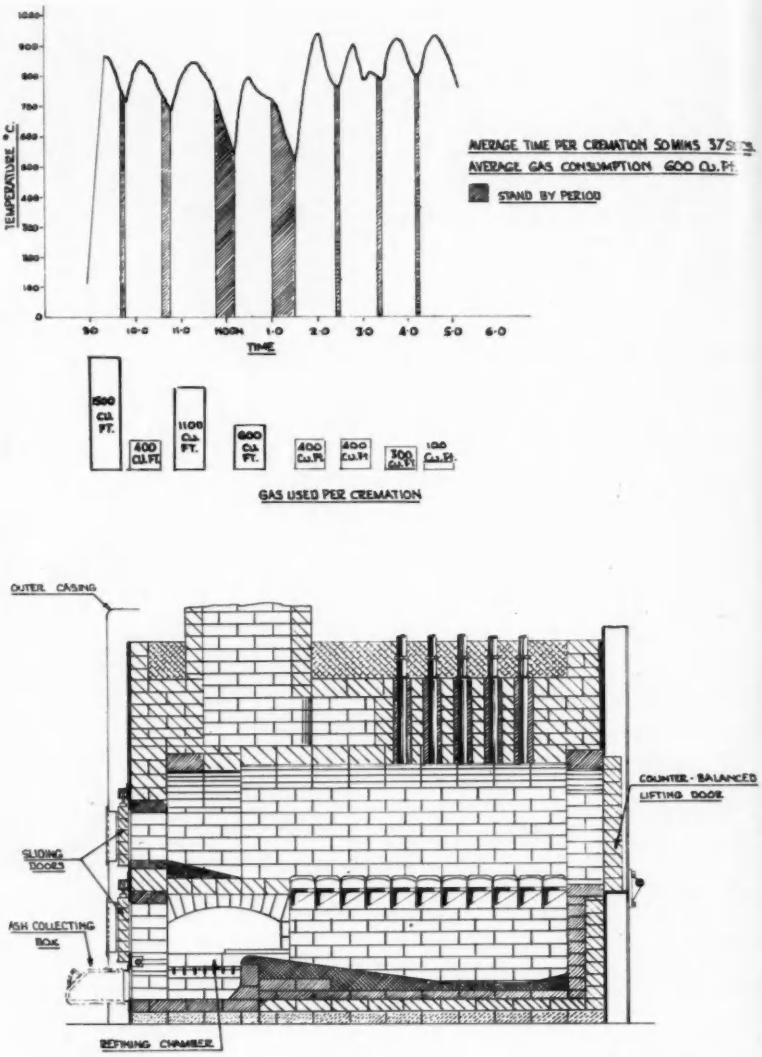


Fig. 6. Above: A typical day's performance of the Diamond cremator. Below: The Diamond cremator.

Control over the flow of combustion products is by means of an adjustable damper which can be controlled so as to direct the combustion products direct into the ash pit chamber when necessary. The main hearth of the cremating chamber is formed from pre-cast refractory with circular runner bars. Provision is made on this cremator to incorporate a heat exchange unit in the flue, and this is used, in conjunction with a gas-fired Potterton boiler, to provide heat for the chapel. When the cremator is in service and the heat exchanger is affording adequate heat emission, then the return water leaving the heat exchanger and passing to the boiler cuts the latter out of service. The use of heat exchangers in this manner is the subject of a provisional patent application.

With complete combustion, as obtains with modern cremators, the provision of a chimney stack is not essential from a technical standpoint, but nevertheless it is desirable for effective dilution of the combustion products, as small quantities of such gases as nitrogen peroxide are produced. In general a minimum height of 25 ft. is felt to be desirable. With the use of larger air supplies, and hence larger fan units, the problem of noise is increased and separate insulated fan rooms are now invariably provided for in crematoria. It is of course most essential that there is adequate free air entry to such fan rooms.